

# Opportunities for Merging Landsat and Sentinel-2 Data Streams

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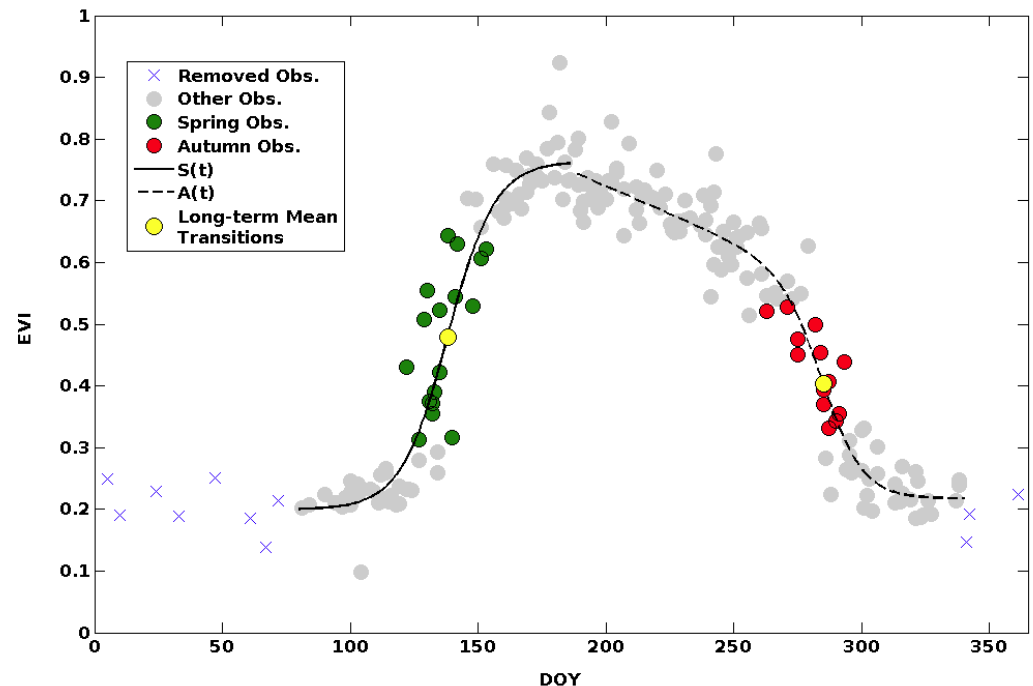
Dec 12, 2012

# Moderate-Resolution Time Series

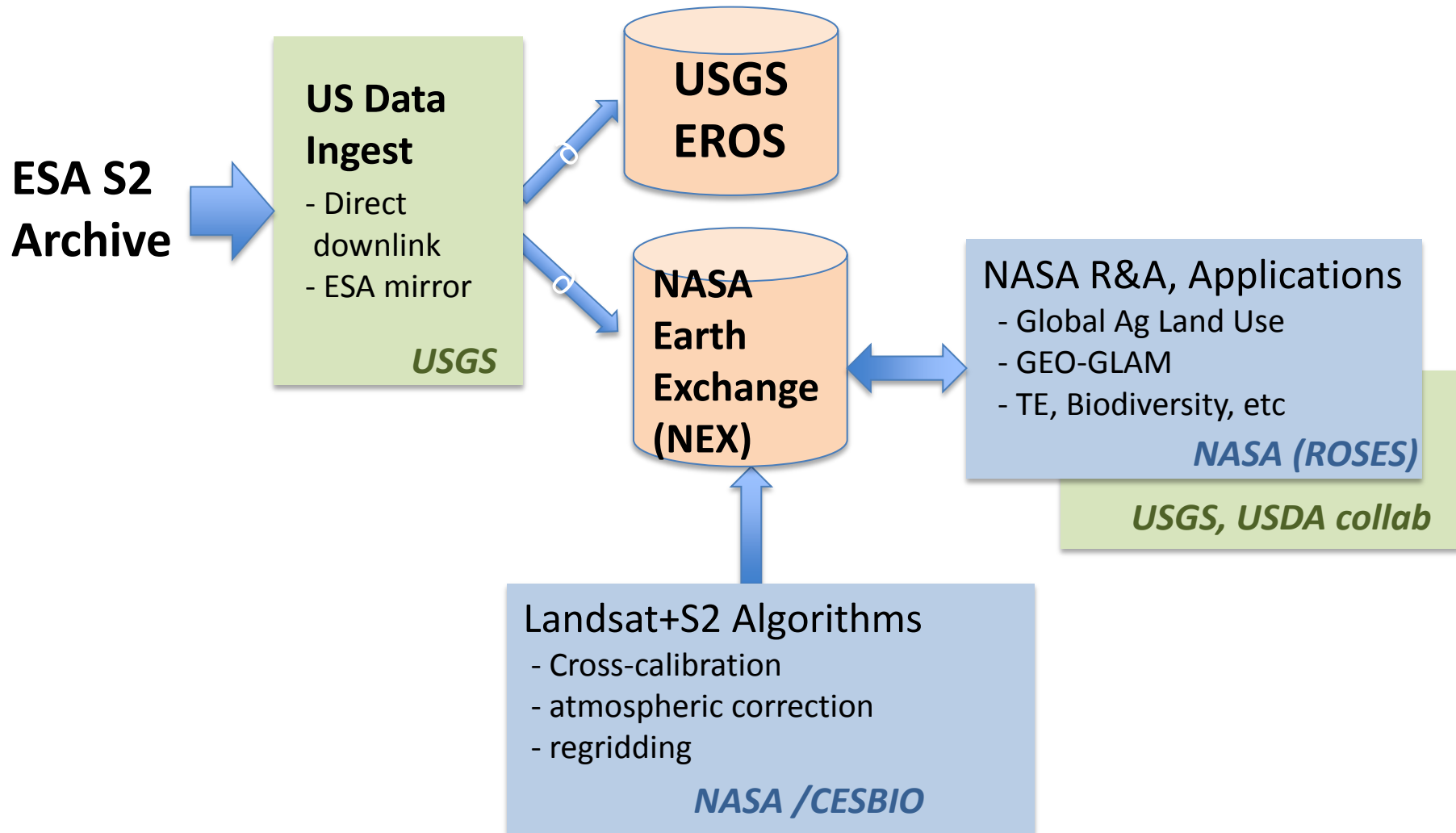
Since the opening of the USGS Landsat archive, there has been increased interest in ***intra-annual*** time series applications at 30m resolution

- Agricultural monitoring
- Vegetation biophysics (LAI, fPAR, productivity)
- Phenology and climate linkages
- WELD data products (SDSU/Roy)

Example: New England forest phenology from multi-annual Landsat observations, courtesy Mark Friedl (BU)



# Proposed Sentinel-2 / Landsat Architecture



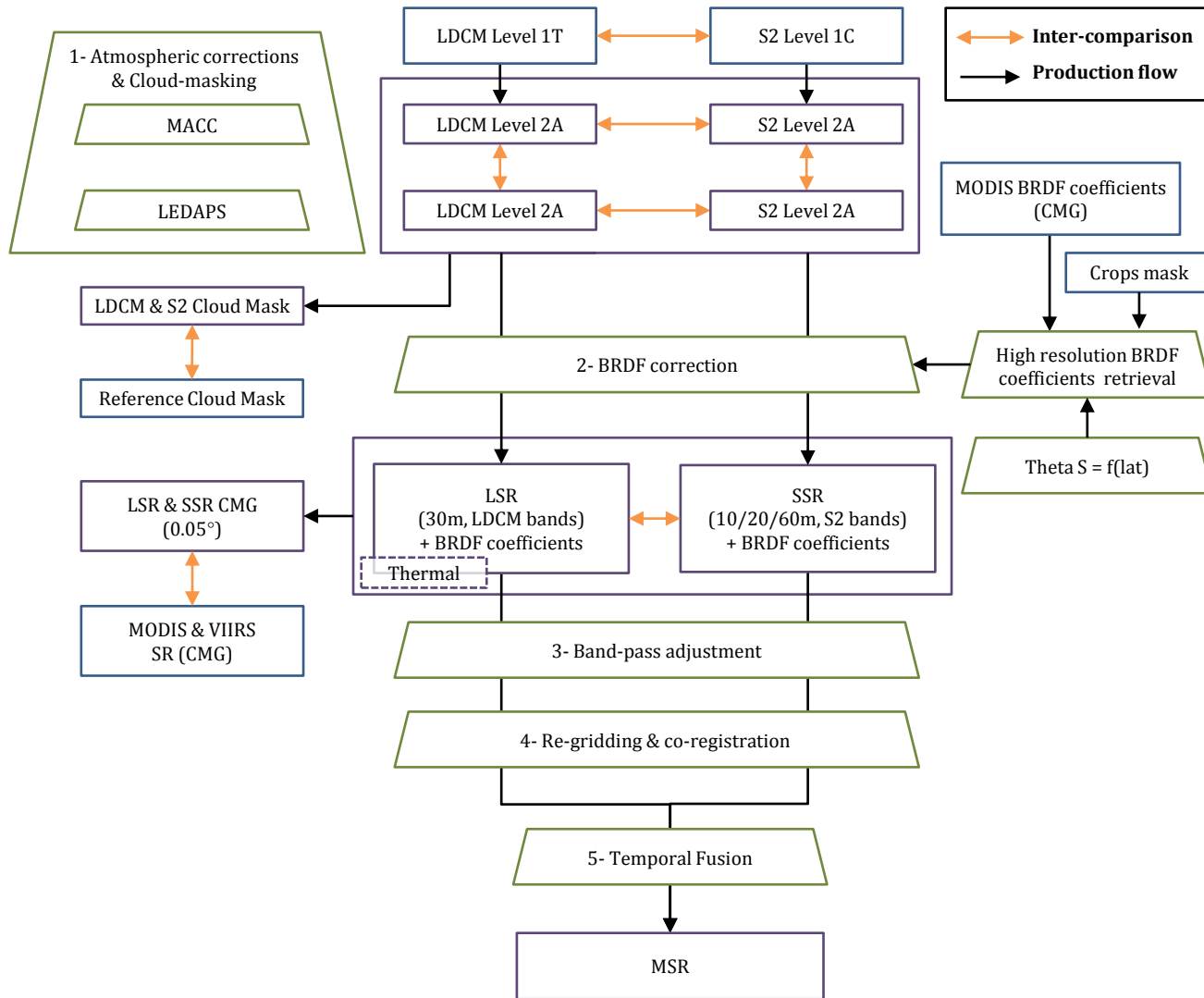
# Activities

1. Develop algorithms to make Sentinel-2 and Landsat/LDCM data *compatible*
2. Support USGS in securing access to Sentinel-2 data for US investigators
3. Pursue prototyping GEO-GLAM agricultural monitoring (crop area, type, condition)
  - Collaborate with USDA, USGS, JRC MARS
  - Phased approach: test sites -> large-area

# 1. Merged Radiometric Record

- Collaboration with UMD, CNES/CESBIO, GSFC, ARC, USGS
  - First meeting held Oct 25-26 2012 @ GSFC
- Goal: “seamless” surface reflectance product with <5 day repeat to support GEO-GLAM
  - Three products identified: Landsat SR (LSR), Sentinel SR (SSR), and Merged SR (MSR)
- Radiometric Adjustments
  - Cross-calibration
  - Atmospheric correction (6S, MACC)
  - BRDF correction to nadir & constant SZA
  - Bandpass correction
  - Regridding and compositing (TBD)
- Initial prototyping using SPOT-4 and L7 data (Spring 2013)

# Merged Radiometric Record



## 2. Sentinel-2 Data Access: Background

- Sentinel-2 data will be transmitted via X-band to four ground stations
  - Alaska, Svalbard, Matera, and Maspalomas
  - No processing capabilities will be hosted at these ground stations
- Mission data will be sent to Processing and Archive Centers (PACs)
  - United Kingdom
  - Spain
- PACs will process and distribute Level-1b (radiometrically corrected) and Level-1c (precision/terrain corrected) products

# ESA Collaboration with NASA and USGS

- NASA will be the principal U.S. agency to work with ESA on Sentinel-1 and -3 collaboration
- USGS will be the principal agency to work with ESA on Sentinel-2 collaboration
- NASA and the USGS will work seamlessly across agencies to address topics of mutual interest
  - Establish mirror archives
  - Science and applications support (e.g. agriculture)



# Sentinel-2 Mirror Archives

- The USGS is interested in hosting mirror archives of Sentinel-2 data
  - Initially will focus on Level-1c products (100 Km by 100 Km granules) as soon as they are made available from the PACs
  - Ensure synchronization of U.S. and ESA inventories
    - US would serve as a “hot back-up”
  - May investigate Level-1b products
    - To enable generation of larger Level-1c granules conforming to Landsat WRS-2 scenes or WELD tiles
    - To enable the generation of high-level geophysical and biophysical parameters
- USGS also investigating direct downlink options for S2

# Data Access Challenges

- Sentinel-2 Data Policy and Operations Budget still unclear
  - Announcement at EU US Space Dialogue that all of the Sentinel data will be free and open with no copyright issues.
- Access to science processing software from ESA or Vendors is to be resolved
  - May be limited to binary executables rather than source code
  - Cost and terms of software licenses unknown
- Need to establish network capability between Europe and U.S.
  - Martha Maiden has requested the ESDIS project to investigate potential solutions
- Support of near real-time applications in U.S. or North America may not be feasible

# Conclusions

- Combining Sentinel-2 and Landsat observations can provide global, <5 day coverage
- USGS and NASA are engaged in establishing a framework for...
  - US access to Sentinel-2 data
  - Algorithm and processing approaches for creating a merged data stream
  - Improved LCLUC and agricultural monitoring applications via merged data stream
- LST engagement highly desired

TABLE 1: TASKS PLAN

#	Tasks	category	schedule	responsibility
1	Select and request 2 JECAM site(s) for SPOT-4 Take-five and insure the Landsat-7 and LDCM acquisition	SPOT-4 T5	11/2012	UMD (Whitcraft / Claverie / Masek)
2	Make a choice on the spatial resolution of the MSR product by (ii) analyzing field size distribution based on geowiki data (see D2_P2 slide 46) (i) Analyzing spatial consistency of Landsat-7 and LDCM based on very high spatial resolution data (<5m).	Product definition	03/2013	UMD and/or NASA-GSFC (Whitcraft / Claverie / Vermote)
3	Make a choice on the temporal and spectral characteristics of the MSR product	Product definition	03/2013	UMD and/or NASA-GSFC (Claverie / Vermote / Masek)
4	Make a choice on the projection systems, the tiling system of MSR	Product definition	03/2013	UMD and/or NASA-GSFC (Claverie / Vermote / Masek)
5	Design a method to retrieve high spatial resolution BRDF coefficient based on coarse spatial resolution BRDF coefficient (MODIS) desegregation.	R & D	03/2013	UMD and/or NASA-GSFC (Claverie / Vermote)
6	Design a Band-pass adjustment method	R & D	04/2013	UMD and/or NASA-GSFC (Claverie / Vermote)
7	Design a temporal fusion method (WELD-like)	R & D	05/2013	UMD and/or NASA-GSFC (Claverie / Vermote / Masek)
8	Design the algorithm chain by concatenating atmospheric correction, BRDF correction, Band-pass adjustment and temporal fusion methods.	R & D	06/2013	UMD and/or NASA-GSFC (Claverie / Vermote / Masek)
9	Create a common dataset including data from Landsat-7 ETM+, LDCM OLI and SPOT-4 Take-five HRVIR.	data handling	07/2013	NASA-GSFC
10	CESBIO meeting (see section 7)	Meeting	07/2013	UMD, NASA-GSFC/ARC, CESBIO
11	Apply MACC atmospheric correction and cloud and cloud shadow masking methods on the previously	Prototyping	08/2013	CESBIO (Hagolle)